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10/037,059	12/31/2001	Yixin Yao	10541-038	5530

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EXAMINER	
ZHU, JERRY	

ART UNIT	PAPER NUMBER
2121	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/037,059	YAO ET AL.	
	Examiner	Art Unit	
	Jerry Zhu	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) 1-18 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) 1-18 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-18 rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art (admission) in view of Davis et, al. U.S. Patent# 5,974,350 (Davis).

Claim 1

1. Admission discloses a road wheel control system (Fig.1) for an automotive vehicle comprising:
   - A control unit (Fig.1, road wheel controller 107) receiving a plurality of input signals (Fig.1, reference input signal 108, vehicle dynamics signal 109, and road wheel angle signal 113) and generating a control output signal (Fig.1 unlabelled signal from road wheel controller 107 to Actuator Power Electronics 104);
   - A road wheel subsystem (Fig.1, road wheel actuator 103, road wheels 101, and their linkages) receiving said control output signal (Fig.1, signal from 104 to 103) and generating an output feedback signal (Fig.1, vehicle dynamics signals 109) to the control unit.

Admission does not disclose the implementation of the control unit using fuzzy logic that is capable of tracking and controlling uncertainty and disturbance effects.

Davis teaches a controller (Fig.1) that performs general-purpose fuzzy logic control functions (col.3, lin.3-5) and takes a plurality of input signals and generates a control output signal (Fig.1, elements 110 and 112).

Motivation: Admission teaches that there are two problems for the control of a steer-by-wire road wheel system. The first is that the changing road, load, and external circumstances change the vehicle dynamics. The second is the severe nonlinear characteristics. These two problems pose difficulties for the road wheel control system modeling and control (admission, paragraph 4 and 5). It has been proved that fuzzy logic is highly effective in controlling complex systems (Davis, col.1, lin.19-22). The controller taught by Davis uses fuzzy logic and is anticipated to overcome the difficulties cited above and is designed to perform general-purpose so that the controller can be applied to any control subsystems in vehicle environment.

One of ordinary skill in the art would have implemented the road wheel control system by using fuzzy logic taught by Davis to track an input signal under effects

of uncertainty and disturbance of the road wheel subsystem and vehicle dynamics and provide vehicle stability control. As a result it would have been obvious to one of ordinary skill in the art at the time of applicants' invention to modify the system taught in the admission by adding the fuzzy control logic taught by Davis.

Claim 2

2. By replacing road wheel controller in admission displayed in Fig.1 with fuzzy engine disclosed by Davis (Fig.3), it derives the road wheel fuzzy logic control system. (The combining of admission with Davis will lead to certain circuit modifications. These modifications are the result of incorporating more features the fuzzy logic provides and therefore do not change the nature of obviousness of combining the two to form the road wheel control system using fuzzy logic.) The road wheel subsystem described in claim 1 comprising:
   - Motor drive (admission, Fig.1, actuator power electronics 104) receiving input as second control output signal (Fig.1 signal from 107 to 104) and generating a motor drive output signal. (Fig.1, signal from 104 to 103)
   - The second control output signal comprising the sum of the control output signal and a second control input signal. (The fuzzy controller taught by Davis has multi-input and multi-output signals. (col.2, lin.2-16) It would be obvious for an ordinary skill in the art at the time of this invention to implement the fuzzy engine in such a way that the second output signal is the sum of second input and first output signals.)

- A controlled plant receiving the second control output (admission, Fig.1, signal from 107 to 104) and generating a road wheel rate signal and a road wheel angle signal. (admission, Fig.1, signal 109, paragraph 3, lin.1-2)

Claims 3-4

3. Claim 3 repeats part of claim 1. Claim 1 says that fuzzy logic control unit tracks and controls the effects of uncertainty and disturbance while claim 2 says that the control system uses fuzzy logic to control uncertainty and disturbance. Therefore the rejection of claim 3 is the same rationale as cited in the rejection of rejected claim 1.
4. (Claim 4) In the road wheel control system disclosed in Admission, the controller has an input signal that is reference angle signal. (Fig.1, element 108; paragraph 2, lin.5-7) Accordingly the combination of admission and Davis, the fuzzy control system, will have a reference angle input as an input signal.

Claim 5-8

5. Claim 5 is anticipated by admission where the controlled plant comprises:
   - Vehicle dynamics sensor array (Fig.1 element 111) for sensing a dynamic variable (Fig.1, the input signal to element 111) that comprises:
     - (claim 6) a yaw rate signal (para 3, lin.1-3)
     - (claim 7) a vehicle speed signal (para 3, lin.1-3)
     - (claim 8) a lateral acceleration signal (para 3, lin.1-3)

- Vehicle dynamics sensor array receiving road wheel angle signal (Fig.1, the input signal to element 111) and generating a vehicle control output signal (Fig.1, signal 109)
- And actuator-based road wheel dynamics receiving a vehicle control input signal (Fig. 1, signal input to Road Wheel Actuator 103) and generating road wheel angle signal and rate signal (Fig.1, input signal to Vehicle Dynamics Sensor 111; paragraph 3, line 1-4)
- The vehicle control signal is the sum of vehicle control output signal and motor drive output signal (Fig.1, signals 108 and 109)

Claim 9

6. Claim 9 adds a rate feedback compensator that receives wheel rate signal and generate second control input signal.
   - Admission teaches ways to feedback signals to the controller but admission doesn't teach a compensator to compensate certain feedback signals such as wheel rate signal.
   - However, using a compensator for certain feedback signal is a design choice and add little novelty to output feedback control concept that is common taught in texts. Therefore Examiner take Official Notice that using a compensator to compensate certain feedback signals as needed is a design choice and common knowledge. See Franklin et, al "Digital Control of Dynamic Systems" page 24, 2.2.3 PID control where the compensator is proportional, integral, and derivative.

- It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify admission by adding a compensator to compensate wheel rate signal as design choice since Examiner takes Office Notice that practical try and error may lead to better result by compensating some of the feedback signals.

Claim 10-12

7. (claim 10) The road wheel control system taught by admission in claim 1 receives dynamic variable (Fig.1, signal 109) as input signal and wheel angle signal (Fig.1, signal 113) as input signal. The controller receives the input signals, generates control output signals that are converted and sent to the road wheel actuator. (Paragraph 3) The vehicle dynamics signal is used to control vehicle stability and the wheel angle signal is used to control road wheel angle accuracy through road wheel controller.

Admission does not teach the implementation of the road wheel controller using fuzzy logic. Davis teaches a controller (Fig.1) that performs general-purpose fuzzy logic control functions (col.3, lin.3-5) and takes a plurality of input signals and generate control output signals (Fig.1, elements 110 and 112).

It would be obvious for an ordinary skill in the art to implement the road wheel control system by using fuzzy logic taught by Davis into a stability control unit that receives and process dynamic variable input signal to control vehicle stability and road wheel

control unit that receives and processes wheel angle (Examiner takes Office Notice that converting a signal into a change rate signal is commonly taught and practiced in control applications) and controls the wheel angle accuracy. As a result it would have been obvious to one of ordinary skill in the art at the time of applicants' invention to modify the system taught in the admission by adding the fuzzy control logic taught by Davis into an implementation that has stability control unit and wheel control unit.

8. (claim 11) Admission teaches the wheel controller with a single output signal that combines the stability output signal and wheel angle output signal. (Fig. 1 signal from 107 to 104) Therefor the combined admission and Davis would have a control output signal that is the sum of vehicle stability control output signal and road wheel control output signal

9. (claim 12) Measuring output signal and generating error signal, error change signal, and error acceleration signal for control design is a design choice and has little patentability content. Further more, Examiner takes Official Notice that the construction of error dynamics for controller design is commonly taught in texts and widely practiced in control engineering. For example, PID control is one way of constructing error dynamics for controller design (Franklin, Page 66). Regardless whether others have constructed error dynamics for control design in the same way or not, the order of error dynamics and the selection of parameters are subject to mathematic proof and experimental testing. Therefore, claim 12 is anticipated by this Official Notice.

Claims 13-14

10. Examiner takes Office Notice that it is commonly taught in texts and widely practiced in control engineering to gauge the gain parameter for control effects. Therefore claims 13 and 14 are anticipated by this Office Notice.

Claims 15-18

11. Claim 15 states the general concept of fuzzy logic in control applications. Davis teaches the generating linguistic variable form numerical input (col.3, lin.3-10), generating hypothesis and fuzzy rule (col.3, lin.17-28), generating a numerical output (col. 3, lin.10-16). Examiner takes Office Notice that applying the control output signals to the controlled dynamics that produce plant output signals to be used as part of control input signals is called output feedback control in texts and commonly practiced in field.

3. Claim 16-18 are anticipated by admission as claims 6-8 that the control system receives signals that include a yaw rate signal, a vehicle speed signal, and a lateral acceleration signal (para 3, lin.1-3)

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

"Servo Control System" by Kariya et, al. (U.S. Patent 5001640)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jerry Zhu whose telephone number is (571) 2724237. The examiner can normally be reached on 8:30 - 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anthony Knight can be reached on (571) 272-3687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jerry Zhu
Examiner
Art Unit - 2121
2/22/2005

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